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AGRICULTURAL NEWS LETTER

VOL. 12 - NO. 2 MARCH-APRIL, 1944

This publication contains information regarding new developments of interest to agriculture based on laboratory and field investigations of the du Pont Company and its subsidiary companies. It also contains published reports and direct contributions of investigators of agricultural experiment stations and other institutions as related to the Company's products and other subjects of agricultural interest.

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"SOLDIERS OF THE SOIL" - DU PONT FILM - ENTHUSIASTICALLY RECEIVED

"Soldiers of the Soil," Du Pont's new motion picture portrayal of a whole generation of life on a typical American farm, highlighting the broad sweep of agriculture and its relation to vital war needs, is being characterized by competent critics as an outstanding industrial film.

Hundreds of letters from all over the United States, all containing praise for the presentation, are being received constantly from agriculturists who have seen the picture in recent weeks.

Tribute to Farmers of America

This 38-minute sound film, presented by Du Pont as "a tribute to the farmers of America," is a distinct departure from the usual film of industrial sponsorship. Its purpose is two-fold: to help the war effort by emphasizing the importance of adequate management and farm labor to insure production of absolutely essential food, fiber, and fats; and to direct the attention of farmers to the abundance of chemical and other scientific aids at their command.

While documented with facts, this screen drama deals with people with the heartbreaks and triumphs of an everyday farm family dedicated to the soil. It unfolds the stirring story of how one farmer finds his answer to his country's call to arms when his older brother, a blinded marine, comes home from the front.

How to Obtain a Print for Local Presentation

Prints, both 16 mm. and 35 mm., are being distributed direct from Wilmington, Delaware, and also through practically all of the usual State depositories, including the State headquarters of the Agricultural Extension Services, most of the State Supervisors of Vocational Agriculture, and similar established institutions and organizations that function for agriculture. A list of the depositories in any designated State will be sent on request.

In the event local distribution centers cannot take care of requests made direct to them, because of previous bookings of available films, a print can be obtained by writing, sufficiently in advance of date of showing to permit handling, direct to the Editor, Du Pont "Agricultural News Letter," Room 13067, Du Pont Building, Wilmington, 98, Delaware.

DU PONT CONSTRUCTING PLANT TO MAKE DDT -- NEW INSECTICIDE

Production of DDT, the new and powerful chemical weapon protecting the armed forces from typhus, will be increased by the construction of a plant by the Du Pont Company.

A difficult compound to make, DDT, or dichloro-diphenyl-trichloroethane, is such an effective insecticide that the Army recently flew the first 500-pound cargo produced at a Du Pont pilot plant to an overseas front. Tonnage manufacture at the new half-million dollar plant to be built at Government request will be entirely devoted to Army and Navy use.

Some conception of DDT's potency may be had from the fact that a single application dusted on clothing gives protection from disease-carrying vermin for one month.

Dr. L. N. Markwood, Chemical Unit, Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, says that "since numerous factors enter into the final success or failure of a new insecticide, no specific forecast for the future can be made. However, progress of DDT is well worth watching."

The Du Pont Company, in announcing its plans for starting work on the new DDT plant authorized by the Government, says:

"The chemical was first synthesized 70 years ago by a German chemist, but its use as an insecticide was patented by a Swiss firm, Geigy, Inc., in 1939."

It adds: "The Du Pont Company's Grasselli Chemicals Department is licensed by Geigy & Company, New York City, for the manufacture and sale of the synthetic insecticide. Design engineering and equipment procurement have been rushed for the new plant to meet greatly expanded military requirements."

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PLANT PATHOLOGISTS CRAWL 35 MILES TO GATHER FIELD DATA

Gathering field data on the value of a new fungicide requires a lot of crawling over a lot of loose, cultivated soil. In one series of tests on 49 different farms, Du Pont plant pathologists, under a hot Southern sun, crawled along about 35 miles of peanut rows. Moving along on hands and knees, these scientists counted over 255,000 plants to obtain information under actual farming conditions on the efficiency of "Arasan," the new seed disinfectant and protectant containing tetramethyl thiuram disulfide.

This chemical compound, composed of carbon, hydrogen, nitrogen, and sulfur, but no metal, has demonstrated its effectiveness as a fungicide for such dissimilar seeds as peanuts, corn, and many sorts of vegetables.

And, incidentally, the count made by the crawling phytopathologists along those 185,000 feet of peanut rows, shows that the average per cent increase in stand for "Arasan"-treated over untreated seed ranged roughly from 8 per cent to 103 per cent, the larger increases being for machine-shelled seed.

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PRELIMINARY TESTS WITH "URAMON" FERTILIZER IN FOLIAGE SPRAYS FOR APPLE TREES

Entirely new information developed in experiments with various nitrogen materials used in sprays opens up the possibility of applying to advantage at least a part of the fertilizer nitrogen to apple trees in this manner.

This procedure, in which the nitrogen is applied as part of foliage sprays designed for disease and insect control, was tested with encouraging results by the New York Agricultural Experiment Station. The results were particularly promising when the fertilizer used was nitrogen supplied in the form of urea by "Uramon" fertilizer compound.

Following preliminary studies in which sodium nitrate (both Chilean and synthetic), ammonium nitrate, ammonium sulfate, and "Uramon" were tested, Dr. J. M. Hamilton, plant pathologist stationed at Geneva, N. Y., and Dr. D. H. Palmiter, plant pathologist, and L. C. Anderson, pomologist located at Poughkeepsi, suggest the use of nitrogen in sprays as a means of more accurately controlling the supply of nitrogen in trees.

In their report, published in the "Proceedings of the American Society for Horticultural Science," Vol. 42, 1943, they say that nitrogen applied to trees in sprays may be absorbed by the leaves, and quickly affects the nitrogen content and appearance of the foliage.

Scientists Say Such A Practice Considered Impossible Few Years Ago

"Wettable sulfurs and an available supply of organic nitrogen add to the possibilities of introducing nitrogen into the spray mixture," they add. "Such a practice would have been considered impossible a few years ago with the materials then in use, if for no other reason than the danger of arsenical injury."

The New York scientists state that the results of their studies suggest that "nitrogen (urea) may be applied to apple trees without injury with foliage sprays now designed for disease and insect control." This suggests the possibility of controlling the nutritional status of the tree more closely than might be accomplished by application to the soil, and of applying fertilizers in this way as a supplement to soil treatments.

They also found that the effect of nitrogen in sprays on color of foliage and nitrogen content of leaves slowly or gradually disappeared throughout the season. They point out that it was possible to apply nitrogen in the early part of the season so as to have it available to the plant when needed, and yet not have an excess of nitrogen in the fall to interfere with good coloring of fruit. They add that the value of such a practice might be accentuated during periods of low rainfall or in dry areas.

The nitrogen carriers were applied in quantities to supply equal amounts of nitrogen, with the wettable sulfur, lime, and arsenate of lead, each at 3-100

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concentration, that is, 3 pounds to 100 gallons of water. The nitrates were used at 5-100, and the other materials on a comparable basis. "Uramon," which contains 42% nitrogen in the form of urea, was also tested at 5-100 and 10-100 concentrations. The trees received about 10 to 15 gallons of spray per tree, and the sprays were applied at the pink stage, at petal-fall, and 14 and 30 days after petal-fall.

The nitrate materials were more likely to cause injury than ammonium sulfate or "Uramon." In fact, the "Uramon" was used without injury in heavier concentrations than any of the other materials.

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FARM FLOCKS LAY FOUR OUT OF EVERY FIVE EGGS

Of the more than 423,000,000 hens on 5,150,000 American poultry-producing farms, over 80 per cent are in so-called farm flocks ranging up to 400 hens.

So says Du Pont's new bulletin "Modern Methods of Egg and Poultry Marketing," which adds that flocks of over 400 birds, classified as commercial, make up only slightly more than 1 per cent of all flocks, but produce nearly 19 per cent of the country's eggs.

Half of the flocks in the United States have around 50 hens each and produce 17 per cent of the total egg output.

About a third of the flocks have between 50 and 200 birds, which produce 46 per cent of the eggs.

One-twentieth of the flocks range from 200 to 400 birds, which lay 18 per cent of all the eggs.

NOTE: Du Pont's new poultry booklet, referred to above, was reviewed in some detail in the January-February issue of this publication. Demand has been exceptionally heavy, making necessary the printing of a second edition. A copy will be sent on request to the Editor, Du Pont "Agricultural News Letter," Wilmington 98, Delaware.

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Agricultural News Letter (Du Pont)
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FIRST ISSUE OF DU PONT "POULTRY COMMENT" STRESSES VALUE OF FEED INGREDIENTS

One of the major factors in economical poultry production is a ration that supplies the necessary nutrients, such as proteins, vitamins, and minerals.

So says Dr. R. M. Bethke, Ohio Agricultural Experiment Station, in the lead article in the new four-page bi-monthly publication, "Poultry Comment," which has just been launched by the Organic Chemicals Department of the Du Pont Company.

Dr. Bethke's article, entitled "Feed Shortages Focus Attention On Values of Ingredients," emphasizes the fact that present-day science of feeds and feeding has shown that the total protein, fat, and fiber content of a feed is far from everything in determining its over-all value for growth or egg production. "Consideration must be given to the vitamins, minerals, and the quality of the ingredients employed if the final mixture is to be most effective," he says. "If ingredient value has a place in the formulation of feeds when feedstuffs are plentiful, it most certainly assumes double importance during periods of shortage, as the present."

Discusses Interrelationship of Vitamin D, Phosphorus and Calcium

He discusses various ingredients, pointing out for instance, the interrelationship of vitamin D and phosphorus and calcium in poultry nutrition, adding:

"Experimental work has shown that poultry require somehwat less phosphorus and calcium in their feed when vitamin D is amply supplied than when minimum amounts are used. This means that vitamin D can, in part, compensate for a lowered phosphorus content in the feed by adding extra amounts of this vitamin. However, this does not imply that by adding plenty of vitamin D the phosphorus and calcium content of feeds can be disregarded."

Publication Contains Other Interesting Articles

Other interesting articles in the first issue of "Poultry Comment," dated February, 1944, include a discussion of post-war problems, statistics on the nation's poultry population, egg goals, and explanations of "Types of Vitamin D" and "Choline Deficiency in Soybean Oil Meal."

NOTE: While most agricultural workers interested in poultry nutrition, whose names are available to us, will be automatically placed on the mailing list, you can make sure that your name will be included by sending your request to the Editor, Du Pont "Agricultural News Letter," Wilmington 98, Delaware.

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NEW POTATO AND GARDEN DUSTS CONTROL BOTH INSECTS AND PLANT DISEASES

Two new chemical dusts that give the grower a combination insecticide and fungicide against a wide range of insects and diseases are announced by Du Pont.

These new materials, designed especially for growers of potatoes and of farm garden crops, are Du Pont Potato Dust and Du Pont Garden Dust.

Both New Products Thoroughly Tested in Laboratory and Field

Both of the new products have been thoroughly tested by Du Pont pest control research laboratories under field conditions. They contain no lime or any other harmful diluents, are easy to mix and apply, and can be dusted or sprayed at any time of day.

Du Pont Potato Dust contains Calcium Arsenate insecticide and Copper-A Compound fungicide. It is recommended for control of Colorado potato beetles, flea and blister beetles, hornworms, leaf hoppers, early and late blight and other leaf-spot diseases. The potato dust may be used on tomatoes, eggplants, and peppers, but in that case the fruits should be washed thoroughly before using, to remove any possible poisonous residue.

Du Pont Garden Dust contains synthetic Cryolite insecticide, a material specially manufactured for fineness and uniformity, and the Copper-A Compound fungicide. It is recommended for Mexican bean beetles, flea beetles and blister beetles, striped and twelve-spotted cucumber beetles, leaf hoppers, various caterpillars, "worms" and "slugs" and other chewing insects, as well as various leaf spots, mildews, and "blights" of vegetables and flowers. For sucking insects such as black or green aphis, a nicotine dust or spray should be used.

The garden dust should not be applied to leafy vegetables within 30 days of harvesting. Vegetables sprayed or dusted should be washed well before using. The garden dust is not recommended for cauliflower or broccoli after heading begins nor for beans after the pods begin to form.

New Materials Can Be Used Either As Dust or Spray

The new materials can be used either as a dust at the rate of 1 pound per 1,000 square feet of garden or as a spray (a 5-pound bag makes 27½ gallons of spray), applied every week or ten days during the growing season.

NOTE: Leaflet giving full directions for use of Du Pont Potato Dust and Du Pont Garden Dust will be sent on request to the Editor, Du Pont "Agricultural News Letter," Wilmington 98, Delaware.

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TEXAS EXPERIMENT STATION TESTS PHENOTHIAZINE-SALT MIXTURE

Use of a mixture of phenothiazine and salt to control certain internal parasites that attack sheep offers good prospects of eventually reducing range infestation to a very low or even a vanishing level.

This guarded prediction, made by Dr. I. B. Boughton, Texas Experiment Station veterinarian, is based on evidence obtained in studies carried on for three years by Substation No. 14, Sonora, where Dr. Boughton is stationed.

The tests were made under actual Texas range conditions to ascertain the efficiency of such a mixture, licked by free choice, in controlling round worm parasites of the stomach and intestines, particularly the common stomach worm and the nodular worm of sheep and goats.

The Texas scientist, in a report on the results of his experiments in the December "Sheep and Goat Raiser," characterizes the sharp reduction in, or the complete prevention of, the hatching of the round worm parasite eggs as the most important feature of this method of administering phenothiazine. It is the basis of his hope for ultimate elimination or near-elimination of range infestation.

Dr. Boughton makes it clear that, while the results on the whole have been favorable, the time has not yet arrived for the sheepman to throw away his drenching gun, put the mixture in the salt trough, and forget about the parasites. He points out that in badly infested pastures and during seasons especially favorable to the development of the larvae, individual treatment may be necessary. In fact, he cautions that whether what he calls the tried and true method of individual drenching, properly spaced through the year, will be superseded by the salt-mixture method is a question only time and experience can answer.

Recommends One Part Phenothiazine to Nine Parts Salt

In his experiments, Dr. Boughton found that the average intake of salt was at the rate of four pounds per head per year in the mixture in contrast with the average of seven pounds per head consumption of plain salt. His animals averaged just under 12 grams phenothiazine per month -- about the same quantity as that in an ounce of standard drench.

At this rate, Dr. Boughton says the mixture can be safely offered to sheep as a lick for at least six months consecutively. He adds that while there was no evidence of phenothiazine poisoning among any of the animals, he recommends confining the practice to about six months, during the dangerous summer season of May to October, until more information is available.

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Offers Labor-Saving Inexpensive Means of Control Under Proper Conditions

"On light-to-medium infested ranges and on heavily infested ranges during dry summers which are not favorable for growth of round worm larvae, this mixture, licked free choice, offers a labor-saving, inexpensive means of control," he says. "During the seasons of warm, wet weather, however, there is little question that individual treatment of the animals, in addition to the mixture, will be necessary on the heavily infested ranges."

Dr. Boughton believes that for the time being the best procedure is to drench the grown sheep about the first of May; put the mixture in the trough about four or five days after drenching; and then to drench the lambs at weaning time if necessary; and the rest of the sheep, to be kept on the ranch, when the mixture is removed in October.

NOTE: A new Du Pont booklet, just off the press, dealing with the whole subject of phenothiazine-salt mixtures and summarizing the work of various experimenters all over the country, will be sent on request to the Editor, Du Pont "Agricultural News Letter," Wilmington 98, Delaware.

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ADEQUATE AMOUNTS OF AMMONIUM SULFAMATE WEED KILLER AVAILABLE THIS YEAR

Ammonium sulfamate, the active ingredient in Du Pont "Ammate" weed killer, is available for the first time this year in quantities adequate for home, farm, and orchard use.

This non-flammable material was sold in limited amounts last year as Du Pont Weed Killer, and was successfully used throughout the country to control numerous noxious weeds.

Material Given New Trade Name -- Du Pont "Ammate" Weed Killer

Ammonium sulfamate kills weeds by penetrating into the plant in different ways to kill the tissues. It kills certain woody perennials, such as poison ivy and chokecherry, by penetration and translocation through the plant to the roots.

It kills numerous annuals, such as chickweed and cocklebur, by penetration into the foliage, and a long list of both shallow-rooted and deep-rooted perennials, including dandelion, goldenrod, Canada thistle, and bindweed, by penetration into foliage plus action on the roots in the soil.

Spray application should thoroughly wet the foliage of woody perennials and annuals and should be made soon after rainfall or during high humidity, if possible. For the other perennials, application to foliage and soil should be made before a rain or the area should be irrigated after treatment. High humidity and moist soil help. Soil sterilization caused by application of ammonium sulfamate may be temporary or prolonged, depending on the condition of the soil and the amount of ammonium sulfamate used. Sterility may be shortened by applying crushed limestone or slacked lime after the weeds are dead.

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SYMPTOMS OF YELLOW-RED VIROSIS OR "X" DISEASE OF PEACHES

The yellow-red virosis or "X" disease of peaches is strikingly noticeable by midsummer when the leaves of the diseased branches turn yellow and drop off, displaying purplish-red areas which become brittle and fall out, leaving irregular holes. Infected branches bear no good fruit, but some of the small fruits may mummify and hang on the tree.

On the wild host plant -- chokecherry -- the most striking symptom is the bright yellow to red coloring of the foliage from mid-June until frost. Infected plants become progressively weaker, showing a tendency to form rosettes on the terminal growth and then die.

No variety of peach resistant to the disease has yet been found. The disease spreads rapidly once it becomes established in the orchard.

AMMONIUM SULFAMATE KILLS CHOKECHERRY WHICH SPREADS "X" DISEASE

The wild chokecherry which acts as a bridge to carry the yellow-red virosis or "X" disease from one peach orchard to another can best be destroyed by use of herbicidal sprays, preferably one containing ammonium sulfamate.

That is the conclusion of Dr. D. H. Palmiter and Dr. E. M. Hildebrand, reporting results of three years' experiments conducted by the College of Agriculture at Ithaca and the Agricultural Experiment Station at Geneva, New York.

In Geneva Bulletin No. 704, the New York scientists point out that sodium chlorate is also effective, but that it must be used with great care because it is somewhat injurious to livestock when eaten in quantities; and, since it is an oxidizing agent, materials sprayed with it become very flammable.

Ammonium sulfamate, on the other hand, "is relatively free from these hazards, as it is not toxic to animals and has a retardent action on fire," the bulletin adds. "Both materials have given good kill of chokecherry; but, the sulfamate seems to kill a wider range of plants, which is a point to keep in mind when all of the plants in the hedgerow are to be destroyed."

The bulletin recommends removal of peach trees afflicted with the "X" disease and since, like most virus diseases, the infection is believed to be spread by an insect, destruction of all chockecherries within a radius of 500 feet of the orchard as a preventive measure.

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Chemicals Most Effective on Uncut Plants

It adds that one thorough application of the herbicide containing sodium chlorate or ammonium sulfamate at 3/4 pound to each gallon of water will give an almost complete kill if applied in midsummer to the foliage of plants which have not been recently cut.

"The amount of spray required to cover 100 square feet will vary from 1 to 3 gallons, depending on the density and height of the plants and the type of spray equipment," the report says. "Care should be taken to wet all the leaves from the top and bottom sides. The leaves absorb the toxic salts which are then carried into the roots, so the whole plant is slowly killed. The tops of the sprayed plants should not be cut until two or three weeks later to allow sufficient time for the translocation of the toxic salts throughout the plants above and below ground."

The bulletin makes it clear that where the land is open, cultivation alone will be sufficient to destroy the plant. It adds, however, that the chokecherry is apt to be found mostly along fence rows, stone walls, and rocky places where thorough cultivation is impossible. It continues:

"Under these circumstances, the first impulse is to cut or burn the plants. This is a poor thing to do, for the chokecherry has a vigorous root system; and such treatments, even though repeated several times, have little effect on killing the plants."

The bulletin points out that cutting or burning only makes the plants harder to kill by chemical means, because the tops and leaf surfaces have been removed. For that reason, plants which have been cut within a year before the chemical treatments are made may require a second application later in the same year or during the following season in order to kill any new shoots which may grow up from the roots.

"In any case, it is well to make an inspection every year, since seedlings may continue to come up for some time," the bulletin recommends.

Evidence is presented to show that arsenical types of herbicides are not satisfactory for spraying chokecherries. They kill the leaves so quickly that translocation is stopped before the roots are killed. Ground applications of arsenical materials have also been tried with poor results. Arsenicals are deadly poisons, and animals must be kept away from plants sprayed with them.

NOTE: Ammonium sulfamate is the basic chemical in Du Pont "Ammate" weed killer, which not only kills the chokecherry, but other weeds such as poison ivy, poison oak, wild blackberries, dewberries, ragweed, Russian thistle, gromwell, prickly lettuce, and Canada thistle. A leaflet giving up-to-date information on the use of this new weed killer will be sent upon request to the editor of the Du Pont "Agricultural News Letter", Wilmington, Delaware.

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SUBSTITUTE FOR PERMANGANATE-FORMALDEHYDE METHOD OF FUMIGATION

A substitute for the usual permanganate-formaldehyde method of formaldehyde fumigation is suggested by the Du Pont Company to help meet the situation created by wartime shortage of potassium permanganate.

This alternative method -- called the bleach-formaldehyde process -- was described by D.W. Horn in "The Journal of Industrial & Engineering Chemistry," Vol. 11, No. 2, and is of particular interest to operators of hatcheries and other buildings where respiratory poultry diseases, such as infectious bronchitis and laryngotracheitis, have existed.

Du Pont fumigation authorities point out that, with available supplies of potassium permanganate insufficient to meet all demands, it probably will become increasingly difficult to use the standard permanganate-formalin fumigation method, which calls for use of formaldehyde (37%) measured into suitable crocks, beside which the required amount of crude potassium permanganate crystals are placed.

Tests show, however, that by using 620 grams (1 1/3 lbs.) bleaching powder and 800 cc. (1 7/10 pints) formalin for each 1,000 cubic feet to be fumigated, as much formaldehyde gas will be thrown off into the room as by the use of 250 grams permanganate and 500 cc. formalin.

The same method of application used to fumigate with the permanganate-formalin process should be used. For instance, operators should turn out any burners, place the materials in the room according to instructions, and close all the exits tight. The sealed room should be left overnight or several days, if possible, before opening and airing. And, of course, all chickens must be removed from the structure before fumigation.

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MANY THINGS, FROM BACTERIA TO RODENTS, ARE "PESTS"

Many kinds of pests that annoy man and compete for his means of subsistence exist in both the animal and plant kingdoms.

Dr. Harry F. Dietz, Du Pont Pest Control Research Entomologist, lists the following animal pests: insects; amoebae; worms such as nematodes, snails, slugs, and shipworms; crayfish, barnacles, and sowbugs; spiders, mites, and ticks; reptiles; some mammals, particularly the rodents like rats, mice, and rabbits; and even certain fish and birds. Pests belonging to the plant kingdom are bacteria, fungi, algae, mosses, ferns, and weeds.

Dr. Dietz says pest-control research consists of studies directed toward development of effective means, including suitable chemical insecticides and fungicides, to prevent costly epidemics resulting from widespread outbreaks of such pests.

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USE OF UREA IN FEED FOR RUMINANTS

By Ward H. Sachs
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E. I. du Pont de Nemours & Co. (Inc.)
Wilmington, Delaware

Urea can replace effectively part of the protein* supplements in the ration for ruminants. Work in which urea was used as a substitute for protein concentrates in the ration for cattle has been reported from Hawaii, Kansas, Massachusetts and Wisconsin, and for sheep from Illinois and New York. In all cases, nitrogen supplied in urea was utilized by the animals, although some variation in the efficiency of utilization of urea nitrogen was shown.

Urea is a crystalline, water-soluble organic compound which contains 46% nitrogen. It was the first organic compound to be synthesized and, although first produced more than 100 years ago, it has been made commercially only during recent years.

High Efficiency of Urea Under Proper Conditions

Recently, experiments were reported by Rupel, Bohstedt and Hart of the University of Wisconsin where urea was compared with linseed meal, a highly-prized protein feed, in a ration for dairy cows. Results on cows indicated that with "a suitable ration in respect to carbohydrate content, urea can function as a source of nitrogen as effectively as can oil meal." In this work, urea nitrogen constituted about 46% of the nitrogen of the concentrate mixture and 27% of the nitrogen in the entire ration. Low-protein roughage, timothy hay, and corn silage, were fed to all cows throughout the experiment. The concentrate mixtures used in this comparison were made up as follows:

Linseed Meal Ration		Urea Ration	
	lbs.		lbs.
Ground Yellow corn	32.0	Ground yellow corn	47.5
Ground oats	32.0	Ground oats	47.5
Linseed meal	34.0	Urea	3.0
Ground limestone	1.0	Bone meal	1.0
Iodized salt	1.0	Iodized salt	1.0
	100.0		100.0

*Proteins constitute the major portion of the nitrogen-containing compounds in feed. In calculating crude protein in a material, the nitrogen content is determined and this is multiplied by the factor 6.25 to arrive at the protein content. Thus, a linseed meal containing 5.6% nitrogen would be shown to contain (6.25 x 5.6%) 35% crude protein. Crystal urea containing 46% nitrogen would contain nitrogen equivalent to (6.25 x 46%) 287% crude protein. This simply means that one pound of crystal urea has nitrogen equivalent to 2.87 pounds of crude protein.

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Urea Supplies Nitrogen Only

Since urea supplies only nitrogen, the energy-producing carbohydrates and fats and the phosphorus of the replaced protein supplement must be supplied by other feed materials. At Wisconsin to produce 8,233 pounds of milk having 4% butterfat, the following amounts of concentrates were required:

Linseed Meal Ration		Urea Ration	
	lbs.		lbs.
Linseed meal	1000	Urea	88
Ground corn	941	Ground corn	1393
Ground oats	941	Ground oats	1393
Salt	29	Salt	29
Limestone	29	Bone meal	29

Thus, 452 (1393 minus 941) pounds each of corn and oats were required to replace the energy-producing portion of the linseed meal; and bone meal, which replaced the limestone, supplied phosphorus. In addition, on the urea ration, 57 pounds more timothy hay and 125 pounds more corn silage were consumed.

Variation in Efficiency of Utilization of Urea

Some variation in efficiency of utilization of urea in different experiments has been shown. Results obtained by J. G. Archibald of the Massachusetts Agricultural Experiment Station, where urea was used in a ration for dairy cows, showed that "considerable use was made of the urea, although it was not quite on a par for maintenance and milk production with the standard protein concentrates." There is some evidence that urea is utilized somewhat more efficiently by cattle than by sheep.

Economy of Feeding Urea

The question of economy of feeding urea as compared with protein concentrates is a complex one. It involves the prices of urea, the grains composing the concentrate mixture, roughage, and the protein concentrates used in building the ration. With considerable spread between cost of carbohydrate materials such as corn, oats, and barley, and cost of protein materials such as linseed and cottonseed meals, the use of urea in feed is attractive. The wider this spread becomes, the greater is the inducement to use urea. While the relation of price of carbohydrate to protein concentrate is the most important factor in economy of feeding urea, the relative cost of roughage such as low-protein hay and corn silage is important, since more roughages may be consumed on the urea ration than on a natural protein concentrate ration. The lower these roughages are priced, the more attractive urea feeding becomes. Based on the figures shown earlier, 904 pounds of corn, 904 pounds of oats, 113 pounds of

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timothy hay, 250 pounds of corn silage, 58 pounds of bone meal and 176 pounds of urea would be required to replace one ton of linseed meal and 58 pounds of limestone. When the cost of one ton of linseed meal plus 58 pounds of limestone is more than the combined cost of these other materials, the use of urea becomes profitable.

In using urea to replace natural protein supplements in various rations, it is necessary to add feed materials, such as corn, containing readily digestible carbohydrates to the urea ration to off-set those that would have been supplied by the protein supplement. Usually some suitable source of phosphorus, such as bone meal, should also be supplied. Thus the use of urea in feed will give largest returns in situations where ample supplies of carbohydrate materials are found and protein concentrates are relatively less available. Since urea supplies only nitrogen, its use with larger quantities of the abundant carbohydrate material will make unnecessary shipment of large quantities of carbohydrate which naturally are carried in the protein concentrate such as the oilmeals.

How Urea May be Introduced into a Concentrate Feed

Assuming a satisfactory concentrate feed containing 74% total digestible nutrients and 20% total protein has been produced by the formula No. 1 shown below, it is now desired to prepare a similar feed in which urea replaces some of the natural protein supplements. If the protein supplements, namely, linseed meal, cottonseed meal, and bran, are priced to be most attractive in the order named, then all or most of the bran would be eliminated first, followed by portions of the cottonseed meal. Formula No. 2A suggests how this replacement may be accomplished. Formula No. 2B illustrates how the replacement may be made, under other conditions.

Formula No. 1 — Feed Containing 20 Per Cent Total Protein and 74 Per Cent Total Digestible Nutrients (T.D.N.)

Material	Amount	Analysis		T.D.N.	Total Protein
		T.D.N.	Total Protein		
	lbs.	%	%	lbs.	lbs.
Ground Barley	610	78.7	11.8	480	72
Ground Oats	500	71.5	12.0	357	60
Wheat Bran	300	70.2	15.8	211	47
Cottonseed Meal	400	75.0	43.0	300	172
Linseed Meal	170	78.4	35.3	133	60
Salt	20				
	2000			1481	411
				74% T.D.N.	20.5% Total Protein

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Formula No. 2A — 20 Per Cent Protein Feed in Which Urea is Used

Material	Amount	Analysis		T.D.N.	Total Protein
		T.D.N.	Total Protein		
	lbs.	%	%	lbs.	lbs.
Ground Barley	610	78.7	11.8	480	72
Ground Oats	475	71.5	12.0	340	57
Urea	40		287.0		115
Linseed Meal	170	78.4	35.3	133	60
Cottonseed Meal	130	75.0	43.0	97	56
Ground Corn	540	79.0	9.2	437	50
Salt	20				
Bone Meal	15				
	2000			1487	410
				74% T.D.N.	20.5% Total Protein

Formula No. 2B — 20 Per Cent Protein Feed in Which Urea is Used

Material	Amount	Analysis		T.D.N.	Total Protein
		T.D.N.	Total Protein		
	lbs.	%	%	lbs.	lbs.
Ground Barley	500	78.7	11.8	394	59
Ground Oats	300	71.5	12.0	215	36
Wheat Bran	300	70.2	15.8	211	47
Wheat Middlings	838	78.4	17.4	657	146
Urea	42		287.0		121
Salt	20				
	2000			1477	409
				74% T.D.N.	20.5% Total Protein

Micro-Organisms Enable Animals to Use Urea

When fed in the ration for ruminants, the urea is not used directly. Experiments indicate that urea is rapidly changed to ammonia in the paunch or rumen of the animal. In a short time this ammonia is used by the micro-organisms growing in the feed mass within the rumen. The protein produced by these micro-organisms is later utilized by the animal.

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Urea Should Be Fed Only to Ruminants

Since the nitrogen in urea is converted into utilizable protein through the activities of micro-organisms in the rumen, it can be seen that urea in feed for non-ruminants would be of no value. Urea should be fed only to ruminants such as cattle, sheep, and goats.

Amount of Urea to Use

Urea (46% N) may be used in a ration for ruminants at a level of 1% of the dry matter of the entire ration, or 3% of a concentrate mixture. In dairy sections where hay, silage and homegrown grains are available, a suitable nitrogen level in the concentrate mixture can be secured by the addition of 3 pounds of urea to 97 pounds of the grain mixture. Urea should not be used at a rate in excess of the suggested amounts, as the efficiency of the material falls off rapidly at higher levels of intake. Large excesses may cause injury to kidneys of the animals.

During the present shortage of protein feed, it would seem best to spread the urea available for feed through a large tonnage (28 to 42 pounds of urea per ton of concentrate mixture) rather than use in a small tonnage of feed the maximum amount suggested. Since 7 pounds of urea per ton of feed supply nitrogen equivalent to 1% protein, the use of the amounts mentioned would increase the equivalent protein content 4% and 6% respectively. The natural protein materials replaced in the feed for ruminants can be used for other classes of livestock that are not able to utilize urea.

Avoid Mixing Soybean Meal Containing Active Urease with Urea

Urease, an enzyme that releases ammonia from urea, is found in some soybean meal. Soybean meal containing active urease should not be used in mixtures with urea. Activity of urease in meal can be determined by mixing small portions of meal with urea, moistening, and allowing the mixture to stand in a closed container. If odor of ammonia develops, active urease is present. Most soybean meal does not contain active urease.

Non-Protein Nitrogen Content Must Be Shown

The Association of American Feed Control Officials in the annual meeting held in Washington, D. C. in 1940 adopted the following resolution regarding the use of urea in proprietary feeds: "Be it resolved: that urea and ammonium salts of carbonic acid are acceptable ingredients in proprietary cattle, sheep, and goat feed only, that these materials shall be considered to be adulterants in proprietary feeds for other animals and birds, that the protein equivalent of combined urea and ammoniacal nitrogen be no greater than one-third of the total crude protein nitrogen, and that the following statement of guarantee of crude protein for feeds containing these materials be recommended: Crude Protein, not less than ..... per cent (This includes ..... per cent Equivalent Crude Protein from non-protein Nitrogen)."

NOTE: Reprints of the foregoing article will be sent on request to the Editor, Du Pont "Agricultural News Letter," Wilmington 98, Delaware.

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